



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/614,106	07/08/2003	Hung-Ming Tai	TAIH3002/EM	7689

23364 7590 08/31/2007
BACON & THOMAS, PLLC
625 SLATERS LANE
FOURTH FLOOR
ALEXANDRIA, VA 22314

EXAMINER

STOUFFER, KELLY M

ART UNIT	PAPER NUMBER
----------	--------------

1762

MAIL DATE	DELIVERY MODE
-----------	---------------

08/31/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/614,106

Applicant(s)

TAI ET AL.

Examiner

Kelly Stouffer

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 July 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) 10-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Due to the amendments filed 24 July 2007, the objection to the specification and the 35 USC 112 2nd paragraph rejection of claim 6 are withdrawn.
2. Applicant's arguments filed 24 July 2007 have been fully considered but they are not persuasive. As to claim 1, the applicant argues that Nakayama et al. in view of Smalley does not teach that H is not less than I. However, as was stated in the previous office action, Nakayama et al. discloses providing a substrate (AFM cantilever/tip 6 in Fig 1) having at least a reference level on the surface of the substrate where at least one carbon nanotube (10 in Fig 1) is formed wherein the shortest vertical distance between the top of the nanotube and the reference level is H (as H is described in the specification, a reference level may be chosen at any point with the top of the nanotube to the reference point designated as H). Nakayama et al. states that I (as defined in the applicant's specification) will be less than H, or conversely, H is more than I and not less than I (distance varied in column 4 lines 5-25). It is the examiner's position, that as far and H and I are described in the instant specification, that these are relative terms taught by Nakayama et al., at least as broadly claimed. Additionally, Nakayama et al. discloses providing a discharge electrode (20/22 in Fig 1) and moving the substrate with the platform while applying a voltage pulse to the electrode to cut the nanotube (column 4 lines 5-40).

Further, the applicant argues that the silicon or glass wafer of claim 4 is not disclosed by either reference and the examiner has not offered supporting evidence as to why an AFM probe will be made of silicon. In support of the statement made in the previous office action, the examiner directs the applicants' attention to the instant specification, page 1, where it states that scanning probe microscope tips (which would include AFM tips) are made of Si wafers or glass.

The applicant argues that Nakayama does not disclose a discharge electrode for cutting a nanotube that is a planar or wire electrode as required by claims 5 and 6. However, the electrode of Nakayama et al. is both a plate and a wire (needle) 0-15 degrees from the substrate surface, depending upon one's point of reference (20/22 in Fig 1).

Additionally, the applicant argues that the references do not disclose the claimed voltage range and pulse period in claim 9. However, as was stated in the previous action, the voltage of Nakayama et al. is pulsed (column 4 lines 55-60). Nakayama et al. discloses that the rate at which the nanotube is shortened depends upon the magnitude and pulse frequency of the pulse voltage (column 4 lines 63-67), and thus the magnitude and pulse frequency (discharge time as well) are result-effective variables. One of ordinary skill in the art would modify these quantities to freely control the cutting from ultra-low-speed to high-speed cutting (column 5 lines 15-25). It would have been obvious to one of ordinary skill in the art to modify Nakayama et al. to include the magnitude and pulse frequency in the claimed values absent evidence showing a criticality for the claimed ranges, in order to freely control the cutting from ultra-low-

speed to high-speed cutting. Though the applicant argues that the present invention does not have a gap between the discharge needle and the nanotube, the claim language does not exclude such a feature.

Further, the applicant argues that there is no motivation to combine Nakayama and Smalley because Nakayama shortens a carbon nanotube and Smalley is growing fullerene fibers or nanotubes. However, Nakayama is modified with Smalley only to include using a piezoelectric actuator with a position sensor to move an electrode in accordance with height sensed because positioning the electrode precisely will make the opposing electrode (i.e. the carbon nanotube on the substrate) sharper, a property desirable for microscope probes. One of ordinary skill in the art would look at all equipment available that would be beneficial to making carbon nanotube microscope probes, especially when the equipment would be used to control height, a feature that fits with Nakayama. In addition, though one reference is growing nanotubes and the other is cutting nanotubes, they both use the same set-up in theory for measuring height, Smalley merely improves upon the process by positioning the nanotube precisely using a piezoelectric actuator, therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Nakayama et al. to include using a piezoelectric actuator with a position sensor to move an electrode in accordance with height sensed as taught by Smalley in order to make the opposing electrode sharper.

At least for the above reasons, the 35 USC 103 rejections of the claims are maintained and are repeated here.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1- 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6719602 to Nakayama et al. in view of US Patent 5591312 to Smalley.

Regarding claim 1, Nakayama et al. discloses a method for controlling the length of a carbon nanotube (title) comprising providing a substrate (AFM cantilever/tip 6 in Fig 1) having at least a reference level on the surface of the substrate where at least one carbon nanotube (10 in Fig 1) is formed wherein the shortest vertical distance between the top of the nanotube and the reference level is H (as H is described in the specification, a reference level may be chosen at any point with the top of the nanotube to the reference point designated as H). The platform capable of moving the substrate (one of ordinary skill in the art would recognize that this is inherent to AFM cantilevers), providing a discharge electrode (20/22 in Fig 1) and moving the substrate with the platform while applying a voltage pulse to the electrode to cut the nanotube (column 4 lines 5-40). Nakayama et al. does not include a piezoelectric actuator which positions the electrode with a position sensor for detecting its height relative to the nanotube and determining the value I. Nakayama et al. does state that I (as defined in the applicant's specification) will be less than H (distance varied in column 4 lines 5-25). Smalley teaches using a piezoelectric actuator with a position sensor to move an electrode in accordance with height sensed (column 7-8 lines 55-10 and columns 10-11 lines 57-11) because positioning the electrode precisely will make the opposing electrode (i.e. the carbon nanotube on the substrate) sharper, a property desirable for microscope probes (columns 7-8 lines 62-10).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Nakayama et al. to include using a piezoelectric actuator with a position sensor to move an electrode in accordance with height sensed as taught by Smalley in order to make the opposing electrode sharper.

Regarding claims 2 and 3, one of ordinary skill in the art would recognize that it is obvious for an AFM probe to be moved in the x, y, or z directions.

Regarding claim 4, one of ordinary skill in the art would recognize that it is obvious that an AFM probe be made of silicon.

Regarding claims 5 and 6, the electrode of Nakayama et al. is both a plate and a wire (needle) 0-15 degrees from the substrate surface, depending upon one's point of reference (20/22 in Fig 1).

Regarding claim 7, the carbon nanotubes of Nakayama et al. may be deposited by CVD (column 3 lines 45-55).

Regarding claim 8, the position sensor (40 in Fig 2) of Smalley may be considered a probe sensor as it is inside the chamber (12).

Regarding claim 9, the voltage of Nakayama et al. is pulsed (column 4 lines 55-60). However, Nakayama et al. discloses that the rate at which the nanotube is shortened depends upon the magnitude and pulse frequency of the pulse voltage (column 4 lines 63-67), and thus the magnitude and pulse frequency (discharge time as well) are result-effective variables. One of ordinary skill in the art would modify these quantities to freely control the cutting from ultra-low-speed to high-speed cutting (column 5 lines 15-25). It would have been obvious to one of ordinary skill in the art to

modify Nakayama et al. to include the magnitude and pulse frequency in the claimed values absent evidence showing a criticality for the claimed ranges, in order to freely control the cutting from ultra-low-speed to high-speed cutting.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kelly Stouffer whose telephone number is (571) 272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1762

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kelly Stouffer
Examiner
Art Unit 1762

kms



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER